

REMARKS

Double Patenting

The Examiner rejected Claims 1, 3, 17, and 36 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1 – 4 of U. S. Patent No.: 6,194,743.

Applicants overcome the double patenting rejection by having amended independent Claims 1 and 36 to be patentably distinct from Claims 1 – 4 of U. S. Patent No.: 6,194,743, as shown in the Claim Rejections section. Claims 3 and 17 are dependent from independent Claim 1 and thus also overcome the double patenting rejection.

Claim Rejections – 35 USC § 103

The Examiner rejected Claims 1, 2, 3, 9, 17, and 36.

Claims 1, 2, 3, 9, 17, and 36 recite:

1. A light emitting device comprising:
a substrate;
an n-type semiconductor layer;
an active layer for generating light, said active layer being in electrical contact with said n-type semiconducting layer;
a p-type semiconductor layer in electrical contact with said active layer; and
a p-electrode in electrical contact with said p-type semiconductor layer, said p-electrode comprising at least a layer of silver having a thickness sufficient to reflect greater than 50% of light incident thereon, wherein a portion of said generated light exits said device through said substrate after being reflected from said p-electrode, and wherein said p-electrode further comprises a bonding layer in electrical contact with said layer of silver for making electrical connections to said layer of silver.
2. The light emitting device of Claim 1 wherein said n-type semiconductor layer and said p-type semiconductor layer comprise group III nitride semiconducting materials.
3. The light emitting device of Claim 1 wherein said silver layer is greater than or equal to 20 nm in thickness.
9. The light emitting device of Claim 1 wherein said bonding layer comprises a metal chosen from the group consisting of gold, nickel, aluminum, and indium.
17. The light emitting device of Claim 1 further comprising:
an n-electrode comprising a layer of electrically conducting material in electrical contact with said n-type semiconductor layer; and
A package having first and second conductors thereon electrically connected to said p-electrode and said n-electrode, respectively.
36. A light emitting device comprising:

a substrate;
an n-type semiconductor layer;
an active layer for generating light, said active layer being in electrical contact with said n-type semiconducting layer;
a p-type semiconductor layer in electrical contact with said active layer; and
a p-electrode in electrical contact with said p-type semiconductor layer, said p-electrode comprising at least a substantially transparent layer of silver, and wherein said p-electrode further comprises a bonding layer in electrical contact with said layer of silver for making electrical connections to said layer of silver.

The Examiner states:

Claims 1, 2, 3, 9, 17, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen in view of Shibata et al.

Chen shows (see cover Figure and column 3, line 33 et seq.) a GaN LED with light reflecting electrode which can be Ag (column 4, line 9) but provides no further details. Chen also shows a complete emitter assembly. Shibata et al. Show the use of an electrode structure on GaN where the first layer can be Ag and the second layer can be Au (column 5, line 52). It would have been obvious to include the additional layer as shown by Shibata et al. in the Chen device to provide environmental protection of the Ag layer which is known to be susceptible to reaction with the atmosphere.

With respect to claim 3, it would have been obvious to make the Ag thick enough to insure that complete reflection is obtained.

Applicants amended independent Claims 1 and 36, as described below, making them allowable.

Claims 2, 3, 9, and 17 are dependent on the allowable independent Claim 1, making them also allowable.

The Examiner objected to Claims 4 – 8 and 10 – 16 as being dependent upon a rejected base claim, but stated that these claims would be allowable if rewritten in independent form.

In response, Applicants amended independent Claim 1 to include the limitation of Claim 4:

1.(Amended) A light emitting device comprising:
a substrate;
an n-type semiconductor layer;
an active layer for generating light, said active layer being in electrical contact with said n-type semiconducting layer;
a p-type semiconductor layer in electrical contact with said active layer; and
a p-electrode in electrical contact with said p-type semiconductor layer, said p-electrode comprising at least a layer of silver having a thickness sufficient to reflect greater than 50% of light incident thereon, wherein a portion of said generated light exits said device through said substrate after being reflected from said p-electrode, and wherein said p-electrode further comprises
a bonding layer in electrical contact with said layer of silver for making electrical connections to said layer of silver; and
a fixation layer overlying and in electrical contact with said layer of silver.

The amended independent Claim 1 now overcomes the rejection and is thus allowable. Since Claims 2 – 17 are dependent on the allowable Claim 1, Claims 2 – 17 are allowable as well.

Further, Applicants also amended independent Claim 36 to include the limitation of Claim 4:

36.(Amended) A light emitting device comprising:

- a substrate;
- an n-type semiconductor layer;
- an active layer for generating light, said active layer being in electrical contact with said n-type semiconducting layer;
- a p-type semiconductor layer in electrical contact with said active layer; and
- a p-electrode in electrical contact with said p-type semiconductor layer, said p-electrode comprising at least a substantially transparent layer of silver, and wherein said p-electrode further comprises
 - a bonding layer in electrical contact with said layer of silver for making electrical connections to said layer of silver; and
 - a fixation layer overlying and in electrical contact with said layer of silver.

The amended Claim 36 now overcomes the rejection and is thus allowable.

Finally, Claim 6 has been amended to recite:

6. The light emitting device of Claim 5, wherein said fixation layer comprises a metal chosen from the group consisting of nickel, palladium, gold, aluminum, chromium, titanium, and platinum.

Support for this amendment can be found in the specification on p. 6, ll. 13-14, describing:

While palladium, platinum, nickel, gold, aluminum, chromium, and titanium layers can be utilized to create a reflective electrode, ...

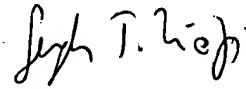
CONCLUSION

For these reasons, it is submitted that all pending Claims, as amended, are in condition for allowance and allowance thereof is requested. If the Examiner's next action is anything other than allowance of all pending Claims, the Examiner is respectfully requested to call Applicants' representative at 415-217-6000.

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Respectfully submitted,



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ATTACHMENT

Hereby the marked up version of the full claim set is provided, showing all amendments explicitly, in accordance with 37 C.F.R. §1.21(1)(c)(ii). Claims that have not been amended are shown in italics.

1.(Amended) A light emitting device comprising:

- a substrate;
- an n-type semiconductor layer;
- an active layer for generating light, said active layer being in electrical contact with said n-type semiconducting layer;
- a p-type semiconductor layer in electrical contact with said active layer; and
- a p-electrode in electrical contact with said p-type semiconductor layer, said p-electrode comprising at least a layer of silver having a thickness sufficient to reflect greater than 50% of light incident thereon, wherein a portion of said generated light exits said device through said substrate after being reflected from said p-electrode, and wherein said p-electrode further comprises
 - a bonding layer in electrical contact with said layer of silver for making electrical connections to said layer of silver; and
 - a fixation layer overlying and in electrical contact with said layer of silver.

2. *The light emitting device of Claim 1 wherein said n-type semiconductor layer and said p-type semiconductor layer comprise group III nitride semiconducting materials.*

3. *The light emitting device of Claim 1 wherein said silver layer is greater than or equal to 20 nm in thickness.*

4.(Cancelled) The light emitting device of Claim 1 wherein said p-electrode further comprises a fixation layer overlying and in electrical contact with said layer of silver.

5.(Amended) The light emitting device of Claim [4]1 wherein said fixation layer comprises a metal.

6.(Amended) The light emitting device of Claim 5 wherein said fixation layer comprises a metal chosen from the group consisting of nickel, palladium, gold, aluminum, chromium, titanium, and platinum.

7. *The light emitting device of Claim 1 wherein said p-electrode further comprises a dielectric fixation layer overlying said layer of silver.*

8. *The light emitting device of Claim 7 wherein said fixation layer comprises a compound chosen from the group consisting of TiO_2 and Al_2O_3 .*

9. *The light emitting device of Claim 1 wherein said bonding layer comprises a metal chosen from the group consisting of gold, nickel, aluminum, and indium.*

10. *The light emitting device of Claim 1 wherein said bonding layer covers less than half of said layer of silver.*

11. *The light emitting device of Claim 1 wherein said bonding layer is a multi-layered structure.*

12. *The light emitting device of Claim 1 wherein said p-electrode further comprises a diffusion barrier layer between said bonding layer and said layer of silver, said diffusion barrier layer providing an electrical path between said bonding layer and said layer of silver, said diffusion barrier layer for preventing constituents from said bonding layer from interdiffusing with said layer of silver.*

13. *The light emitting device of Claim 12 wherein said diffusion barrier layer comprises a metal.*

14. *The light emitting device of Claim 13 wherein said diffusion barrier layer comprises nickel.*

15. *The light emitting device of Claim 12 wherein said diffusion barrier layer encapsulates said layer of silver.*

16. *The light emitting device of Claim 12 wherein said diffusion barrier layer is a multi-layered structure.*

17. *The light emitting device of Claim 1 further comprising:*

an n-electrode comprising a layer of electrically conducting material in electrical contact with said n-type semiconductor layer; and

A package having first and second conductors thereon electrically connected to said p-electrode and said n-electrode, respectively.

36.(Amended) A light emitting device comprising:

a substrate;

an n-type semiconductor layer;

an active layer for generating light, said active layer being in electrical contact with said n-type semiconducting layer;

a p-type semiconductor layer in electrical contact with said active layer; and

a p-electrode in electrical contact with said p-type semiconductor layer, said p-electrode comprising at least a substantially transparent layer of silver, and wherein said p-electrode further comprises

a bonding layer in electrical contact with said layer of silver for making electrical connections to said layer of silver; and

a fixation layer overlying and in electrical contact with said layer of silver.